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The Honorable Ellen O. Tauscher  
Chairman  
The Honorable Terry Everett  
Ranking Minority Member  
Subcommittee on Strategic Forces  
Committee on Armed Services  
House of Representatives

Subject: *Nuclear Weapons: Annual Assessment of the Safety, Performance, and Reliability of the Nation's Stockpile*

In 1992, the United States began a unilateral moratorium on the underground testing of nuclear weapons. Prior to the moratorium, underground nuclear testing was a critical component for evaluating and certifying nuclear warheads.<sup>1</sup> In 1993, the Department of Energy (DOE), at the direction of the President and the Congress, established the Stockpile Stewardship Program to increase understanding of the basic phenomena associated with nuclear weapons, provide better predictive understanding of the safety and reliability of weapons, and ensure a strong scientific and technical basis for future United States nuclear weapons policy objectives.<sup>2</sup> The National Nuclear Security Administration (NNSA), a separately organized agency within DOE, is now responsible for carrying out the Stockpile Stewardship Program through a nuclear weapons complex that comprises three nuclear weapons design laboratories (weapons laboratories), four production plants, and the Nevada Test Site.

In 1995, the President established an annual stockpile assessment and reporting requirement to help ensure that the nation's nuclear weapons remained safe and reliable without underground nuclear testing. This decision was made in the context of negotiating a multilateral Comprehensive Test Ban Treaty to ban all nuclear weapons test explosions. As a condition or safeguard under which the United States would enter into such a test ban, the President established "Safeguard F"—an understanding that if the Secretaries of Energy and Defense informed the President that conducting an underground nuclear test was critical to maintaining confidence in a weapon's safety or reliability, the President, in consultation with the Congress,

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<sup>1</sup>Certification is the process through which the weapons laboratories establish that a particular nuclear warhead or bomb meets its designated military operational specifications.

<sup>2</sup>The National Defense Authorization Act for Fiscal Year 1994, Pub. L. No. 103-160, § 3135 (1993), directed DOE to establish the Stockpile Stewardship Program.

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would be prepared to withdraw from the treaty. While the President submitted Safeguard F along with the Comprehensive Test Ban Treaty to the Senate for ratification in 1997, the Senate voted to reject the treaty in 1999. However, the United States continues to maintain a moratorium on underground nuclear testing as a matter of national policy.

Subsequently, the Congress enacted into law the requirement for an annual stockpile assessment (annual assessment) process in section 3141 of the National Defense Authorization Act for Fiscal Year 2003.<sup>3</sup> Specifically, section 3141 requires that the Secretaries of Energy and Defense submit a package of reports on the results of their annual assessment to the President by March 1 of each year. The President must forward the reports to the Congress by March 15. These reports are prepared individually by the directors of the three DOE weapons laboratories—Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), and Sandia National Laboratories (SNL)—and by the Commander of the U.S. Strategic Command (USSTRATCOM), who is responsible for targeting nuclear weapons within the Department of Defense (DOD). The reports provide each official's assessment of the safety, reliability, and performance of each weapon type in the nuclear stockpile. In addition, the Commander of USSTRATCOM assesses the military effectiveness of the stockpile. In particular, the reports include an assessment about whether it is necessary to conduct an underground nuclear test to resolve any identified issues. The Secretaries of Energy and Defense are required to submit these reports unaltered to the President, along with the conclusions the Secretaries have reached as to the safety, reliability, performance, and military effectiveness of the nuclear stockpile. The Nuclear Weapons Council (NWC), a joint DOD/DOE organization that coordinates nuclear weapons activities between the two departments, supports the two Secretaries in fulfilling their responsibility to inform the President if a return to underground nuclear testing is required to address any issues identified with the stockpile.<sup>4</sup> In this context, you asked us to describe the processes that DOE and DOD have established for fulfilling the requirements of the annual assessment.

To determine the process that DOE and DOD have established to fulfill the annual assessment requirements, we reviewed the major reports and briefings generated during the annual assessment cycles for 2005 and 2006, including the reports generated by the weapons laboratories and USSTRATCOM. We also interviewed DOE and DOD officials, including representatives from NNSA, each weapons laboratory, USSTRATCOM, the NWC, the Air Force, the Navy, and the U.S. Nuclear Command and Control System Support Staff. In addition, we interviewed former National Security Council staff and staff associated with the House and Senate Committees on Armed Services to obtain the perspective of the end users of the annual assessment reports. We conducted our review from April 2006 to December 2006 in accordance with generally accepted government auditing standards.

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<sup>3</sup>Pub. L. No. 107-314, § 3141 (2002).

<sup>4</sup>The National Defense Authorization Act for Fiscal Year 1987, Pub. L. No. 99-661, § 3137 (1986), established the Nuclear Weapons Council. *See* 10 U.S.C. § 179.

## **Summary**

To satisfy the requirements of section 3141 of the National Defense Authorization Act for Fiscal Year 2003, DOD and DOE have established an annual assessment process that reaches conclusions and makes judgments about the U.S. nuclear stockpile and, in particular, whether it is necessary to conduct an underground nuclear test to resolve any questions about a particular weapon type. The annual assessment process takes about 14 months to complete—during which time the nuclear weapons community collaborates on technical issues affecting the safety, reliability, performance, and military effectiveness of the stockpile—and produces seven different types of reports. The annual assessment process culminates in the “Report on Stockpile Assessments” prepared by the NWC, which includes an executive summary, a joint letter signed by the Secretaries of Energy and Defense, and unaltered copies of the weapons laboratory director reports and the Commander of USSTRATCOM report.

The directors of the nuclear weapons laboratories base their reports on the technical work of their laboratories, which is derived from ongoing work associated with NNSA’s Stockpile Stewardship Program, as well as feedback they receive from independent teams of experts from all three of the weapons laboratories. The Commander of USSTRATCOM bases his report on the advice of a technical advisory group, which holds an annual conference bringing together all of the organizations involved in the annual assessment, and additional operational information provided by USSTRATCOM and the military services. The NWC, supported by warhead-specific technical groups, pulls together the information from DOE and DOD. The NWC then produces an executive summary of all of the reports and prepares a joint letter from the Secretaries of Energy and Defense to the President of the United States, which is forwarded to the Congress. While the principal purpose of annual assessment is to provide analysis of and judgments about the safety, reliability, performance, and military effectiveness of the nuclear stockpile, the process would not be used as a vehicle for notifying decision makers about an immediate need to conduct a nuclear test. According to agency and congressional officials, if an issue with a weapon were to arise that required a nuclear test to resolve, the Secretaries of Energy and Defense, the President, and the Congress would be notified immediately and outside of the context of the annual assessment process.

We provided a draft of this report to NNSA and DOD for their review and comment. Overall, NNSA stated that it generally agreed with the findings of the draft report. NNSA also provided technical comments, which we incorporated into the report as appropriate. DOD provided oral comments of a technical nature, which we incorporated into the report as appropriate.

## **Background**

The U.S. nuclear weapons stockpile consists of nine weapon types. (See table 1.) These weapons include gravity bombs deliverable by dual-capable fighter aircraft and long-range bombers; cruise missiles deliverable by aircraft and submarines; submarine-launched ballistic missiles; and intercontinental ballistic missiles.

**Table 1: Current U.S. Nuclear Weapon Types**

Warhead or bomb type	Description	Delivery system	Laboratory	Military service
B61-3/4/10	Tactical bomb	F-15, F-16, Tornado	LANL / SNL	Air Force
B61-7/11	Strategic bomb	B-52, B-2	LANL / SNL	Air Force
W62	ICBM warhead <sup>a</sup>	Minuteman III ICBM	LLNL / SNL	Air Force
W76	SLBM warhead <sup>b</sup>	Trident D5 missile, ballistic-missile submarine	LANL / SNL	Navy
W78	ICBM warhead	Minuteman III ICBM	LANL / SNL	Air Force
W80-0	TLAM/N <sup>c</sup>	Attack submarine	LLNL / SNL	Navy
W80-1	ALCM, ACM <sup>d</sup>	B-52	LLNL / SNL	Air Force
B83-1	Strategic bomb	B-52, B2	LLNL / SNL	Air Force
W87	ICBM warhead	Minuteman III ICBM	LLNL / SNL	Air Force
W88	SLBM warhead	Trident D5 missile, ballistic-missile submarine	LANL / SNL	Navy

Source: NWC.

Note: As of 2005, responsibility for the W80-0/1 was transferred from LANL to LLNL. The W87 is in the process of transitioning from the Peacekeeper missile to the Minuteman III missile.

<sup>a</sup> ICBM = Intercontinental Ballistic Missile.

<sup>b</sup> SLBM = Submarine-Launched Ballistic Missile.

<sup>c</sup> TLAM/N = Tomahawk Land-Attack Missile/Nuclear.

<sup>d</sup> ALCM = Air-Launched Cruise Missile; ACM = Advanced Cruise Missile.

In the context of the annual assessment process, the terms “warhead,” “weapon,” and “delivery system” have different technical meanings.

- A *nuclear warhead* is composed of a nuclear explosive package, which includes the components that produce nuclear energy of a militarily significant yield and a set of supporting nonnuclear components. Depending on the specific weapon type, the supporting nonnuclear components control the use, arming, and firing of the nuclear explosive package.
- A *nuclear weapon* includes the warhead and certain weapon-specific components, such as fuzes, batteries, and reentry vehicles and bodies (in the case of a ballistic missile) that configure the warhead for DOD use in a missile or as a bomb.
- A *delivery system* is the military vehicle—ballistic or cruise missile, airplane, or submarine—by which a nuclear weapon could be delivered to its intended target.

Both DOE and DOD have responsibilities for nuclear weapons. DOE is responsible for nuclear warheads and for nuclear bombs in their entirety (including components such as parachutes). For reentry vehicles and reentry bodies, DOD is responsible for

components that arm the weapon and provide authorization for its use. Specific organization responsibilities are as follows:

- Two DOE weapons laboratories (LANL and LLNL) design the nuclear explosive packages and conduct scientific research and development to better understand nuclear weapons phenomena. The DOE engineering laboratory (SNL) has principal responsibility for the research, design, and development of nonnuclear warhead components; integration of these components with LANL and LLNL; and overall warhead systems integration with DOD.<sup>5</sup>
- DOE's NNSA oversees the management and operation of the weapons laboratories, the Nevada Test Site, and four production plants—the Pantex Plant in Texas, the Y-12 National Security Complex in Tennessee, the Kansas City Plant in Missouri, and a portion of the Savannah River Site in South Carolina. These plants manufacture nuclear warhead components, assemble nuclear weapons, and disassemble and inspect nuclear weapons in preparation for surveillance testing and other activities. The Nevada Test Site maintains the capability to conduct underground nuclear testing and also conducts experiments involving nuclear material and high explosives.
- The military services—the Air Force and the Navy, in the case of the current stockpile—develop the operational specifications for nuclear weapons. These specifications are defined in two documents: (1) the military characteristics document, which describes the required operational performance characteristics (e.g., yield) for a particular warhead type, and (2) the stockpile-to-target sequence document, which describes the normal and abnormal environments a warhead type is expected to encounter throughout its lifetime. In addition, the military services operate nuclear weapons storage sites within the continental United States and are responsible for the safety, security, survivability, movement, storage, and maintenance of all nuclear weapons in those storage areas.
- USSTRATCOM, which was established as a unified combatant command in 1992, has primary responsibility for the use of strategic nuclear forces, including targeting nuclear weapons and preparing the U.S. strategic nuclear war plan. Unified combatant commands are responsible for accomplishing the multiservice missions assigned to them by the Secretary of Defense. Starting in 2002, the mission of USSTRATCOM expanded and now includes responsibilities associated with global strike planning and execution; integrating global ballistic missile defense; overseeing intelligence, surveillance, and reconnaissance; global command and control; DOD information operations; and DOD's efforts to combat weapons of mass destruction.
- The Strategic Advisory Group Stockpile Assessment Team (SAGSAT) is part of a USSTRATCOM advisory committee and provides technical expertise to the USSTRATCOM Commander on nuclear weapons issues. Specifically, SAGSAT

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<sup>5</sup>In addition to these activities, LANL maintains an interim production capability for limited quantities of plutonium components and manufactures nuclear weapon detonators. SNL also manufactures neutron generators.

supports the Commander by (1) conducting an annual conference on nuclear weapons stockpile assessment that considers all nuclear weapons in the stockpile; (2) reporting on trends regarding confidence in the reliability, safety, and surety of the nuclear weapons stockpile and whether nuclear testing is required; and (3) advising on performance and surety issues. The members of the SAGSAT are recognized experts in the nuclear weapons field and are generally retired employees of the national laboratories and military services or have held positions with major defense contractors.

- The NWC is a joint DOD/DOE organization established by the Congress in 1987 to facilitate high-level cooperation and coordination between the two departments as they fulfill their dual responsibilities for securing, maintaining, and sustaining the U.S. nuclear weapons stockpile. The NWC is chaired by the Under Secretary of Defense for Acquisition, Technology and Logistics. Other members include the Vice Chairman of the Joint Chiefs of Staff, the Under Secretary of Energy for Nuclear Security (NNSA Administrator), the Under Secretary of Defense for Policy, and the Commander of USSTRATCOM.
- A Project Officers Group (POG) is a joint DOD/DOE group that is chartered by the NWC at the beginning of a weapon development program.<sup>6</sup> For each weapon type, a POG provides the technical forum for coordinating activities related to the development, sustainment, operational effectiveness, and overall management of the weapon, including the weapon's compatibility with its delivery system. Each POG is led by a lead project officer (LPO) who reports to the NWC through the lead cognizant military service (Air Force or Navy). POG membership is specific to the weapon for which it is responsible but generally includes organizations within DOE and DOD—such as NNSA, the weapons laboratories, combatant commands, and the military services—that expend resources on the weapon.

President Clinton established the requirement for an annual assessment and reporting process in a 1995 statement that accompanied his announcement of support for a Comprehensive Test Ban Treaty: "...I am today directing the establishment of a new annual reporting and certification requirement that will ensure that our nuclear weapons remain safe and reliable under a comprehensive test ban." While the President's original statement uses the term "certification," the nuclear weapons community currently refers to this process as "assessment." The reason for this distinction, according to NNSA and laboratory officials, is that the term "certification" has a specific, technical meaning that is separate from that intended by the annual assessment process. Specifically, certification is the process through which the weapons laboratory directors establish that a particular nuclear warhead or bomb meets its designated military characteristics, stockpile-to-target sequence, and "interface requirements" (compatibility with its delivery system). According to NNSA and laboratory officials, once a warhead is certified, it remains certified until it is either decertified or retired. As a result, annual assessment is not an annual "recertification" of the stockpile; rather, according to officials from NNSA and the weapons laboratories, it is an assessment of whether each warhead type still meets the same standards as it did when it was originally certified.

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<sup>6</sup>Almost all of the current POGs were originally chartered by the Military Liaison Committee, the predecessor of the NWC.

Following the President's 1995 statement, the NWC issued guidance in 1996 to formalize the processes used by DOE and DOD to meet the annual assessment and reporting requirement. Subsequently, in 2001, President Bush reaffirmed that the annual assessment and reporting process would continue. Finally, the National Defense Authorization Act for Fiscal Year 2003 enacted the requirements for annual assessments into law. Specifically, section 3141 of the act requires the director of each weapons laboratory and the Commander of USSTRATCOM to make an annual assessment of the safety, reliability, and performance of each weapon type in the nuclear stockpile. The Commander of USSTRATCOM is also required to make an annual assessment of the military effectiveness of the stockpile. In addition, these officials are required to issue individual reports on their assessments to the Secretaries of Energy and Defense, and to the NWC, by December 1 of each year. These reports must include an assessment as to whether it is necessary to conduct an underground nuclear test to resolve any issues identified in the reports. By March 1 of each year, the Secretaries of Energy and Defense are required to submit these reports unaltered to the President, along with the conclusions that the Secretaries have reached as to the safety, reliability, performance, and military effectiveness of the nuclear stockpile. Finally, the President is required to forward these reports, along with any comments the President considers appropriate, to the Congress no later than March 15 of each year.

Section 3141 of the act also expanded the requirements for annual assessment beyond the original process established in 1996. More specifically, it required

- the weapons laboratory directors and the Commander of USSTRATCOM to include in their reports (1) an identification of specific underground nuclear tests that, while not necessary, might have value in resolving any identified issues, and (2) a determination of the readiness of the United States to conduct an underground nuclear test (where one is deemed to be necessary or valuable),
- the weapons laboratory directors to include in their reports (1) a summary of findings from "red teams," made up of experts from all three weapons laboratories, who have reviewed technical laboratory information and subjected it to challenge; (2) a concise statement regarding the adequacy of science-based tools and methods used in making the assessment; and (3) a concise statement regarding the adequacy of tools and methods employed by the manufacturing infrastructure to identify and fix any problems addressed by the assessment, and
- the Commander of USSTRATCOM to include in his report (1) a discussion of the relative merits of other nuclear weapon types or compensatory measures that could be taken should any deficiency be identified and (2) identification of any matter having an adverse effect on the Commander's ability to accurately address the issues covered by the assessment.



Events over the past several years have served to intensify concern about how the United States maintains its nuclear deterrent. Specifically,

- The 2001 Nuclear Posture Review stated, among other things, that Cold War practices related to nuclear weapons planning were obsolete, and few changes had been made to the size or composition of the nation's nuclear forces. Furthermore, the review found that there had been underinvestment in the nuclear weapons complex, particularly the production sites. The review called for, among other things, the development of a "responsive infrastructure" that would be sized to meet the needs of a smaller nuclear deterrent while having the capability of responding to future strategic challenges.
- The 2002 Moscow Treaty between the United States and Russia set a goal of reducing the number of operationally deployed strategic U.S. nuclear warheads to between 1,700 and 2,200 by 2012. However, a significant number of existing warheads will be kept in reserve as augmentation warheads to address potential technical contingencies with the existing stockpile or geopolitical changes.
- In recent congressional testimony, the Secretary of Energy and the Administrator of NNSA emphasized that while they believe stockpile stewardship is working, the current Cold War legacy stockpile is wrong for the long term, and the current nuclear weapons infrastructure is not responsive to unanticipated events or emerging threats.
- NNSA and DOD created the Reliable Replacement Warhead program to study a new approach for providing a credible nuclear warhead deterrent over the long term.<sup>7</sup> The Reliable Replacement Warhead program would redesign weapon components to be easier to manufacture, maintain, dismantle, and certify without nuclear testing, potentially allowing NNSA to transition to a smaller and more efficient weapons complex. A design competition between LANL and LLNL was originally scheduled to be completed in November 2006. While NNSA and DOD have not yet announced the selection of a preferred design, the two departments have determined that the RRW is feasible.
- Finally, in 2006, NNSA offered a proposal to address long-standing problems with the condition and responsiveness of the nuclear production facilities. Under its plan—*Complex 2030: A Preferred Infrastructure Planning Scenario for the Nuclear Weapons Complex*—NNSA proposed to build a new, consolidated plutonium center at a yet-to-be determined location that would replace the interim plutonium production capability at LANL. A key responsibility of the plutonium center would be to manufacture components for a Reliable Replacement Warhead-based stockpile. In addition, NNSA proposed modernizing the remaining production capabilities at their existing locations, including the Y-12 National Security Complex, Savannah River Site, and Pantex Plant. NNSA also proposed

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<sup>7</sup>The conference report accompanying DOE's fiscal year 2005 appropriations act provided that funds appropriated were available for the Reliable Replacement Warhead Program. H.R. Rep. No. 108-792, Div. C, at 951 (2004), accompanying the fiscal year 2005 Consolidated Appropriations Act, Pub. L. No. 108-447.

eventually removing all weapons-grade material from the three weapons laboratories.

### **The Annual Assessment Process Results in a Package of Reports That Make Conclusions and Judgments about the Nuclear Stockpile**

The annual assessment process results in a series of high-level reports that make conclusions and judgments about the safety, performance, reliability, and military effectiveness of the weapons in the nuclear stockpile and whether there is a technical issue that requires resolution through underground nuclear testing. These high-level reports are underpinned by technical reports that capture ongoing work on the stockpile, specifically activities associated with DOE's Stockpile Stewardship Program and other DOD surveillance activities. In total, the following seven types of reports are produced during a single annual assessment cycle:

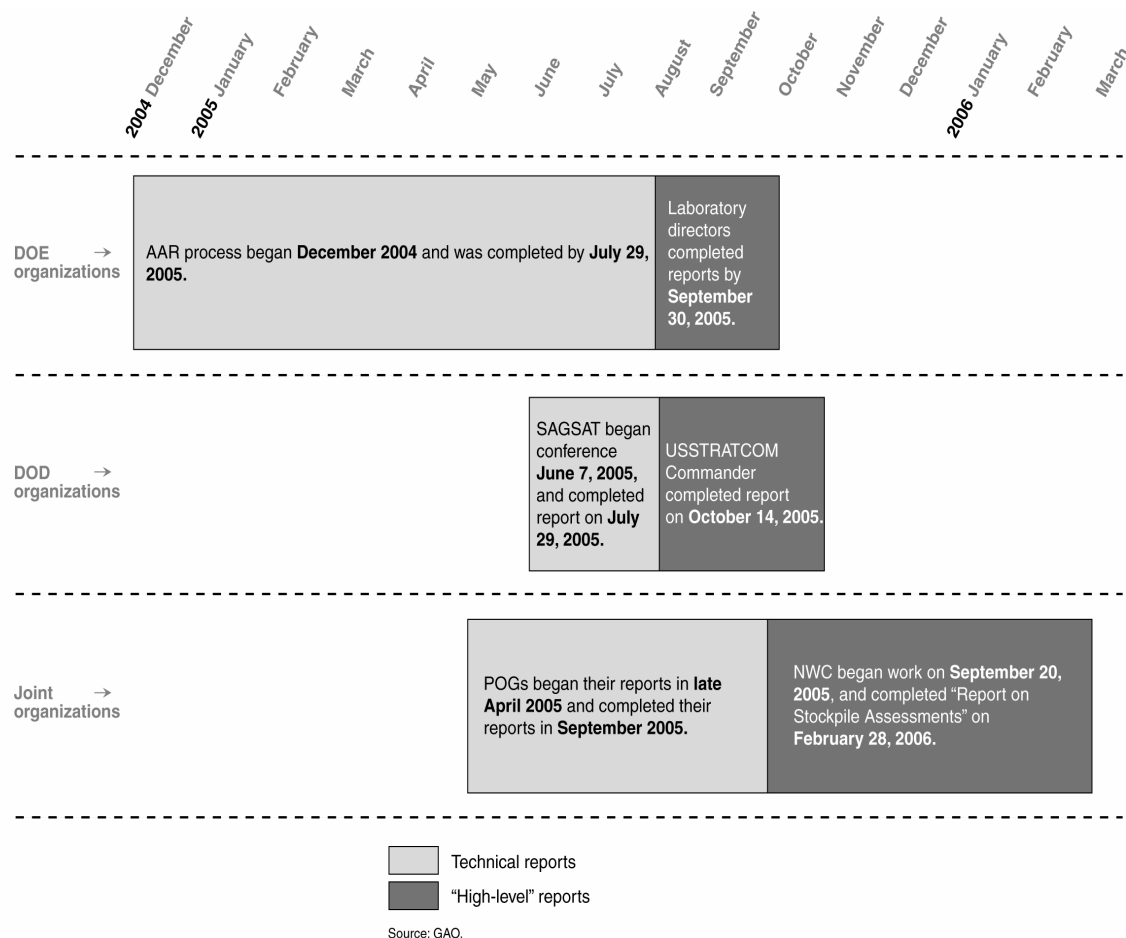
- *Weapons Laboratory Annual Assessment Reports (AARs)*: AARs are prepared for each weapon type by the technical staff of the weapons laboratory responsible for the nuclear explosive package (LANL or LLNL) and their engineering counterpart at SNL. Each AAR contains technical information concerning the potential need for underground nuclear testing and whether each warhead type meets its required military characteristics, such as warhead yield, throughout its stockpile-to-target sequence.
- *Weapons Laboratory Red Team Reports*: A red team at each weapons laboratory issues a report to the laboratory director that assesses the technical information contained in the laboratory's AARs and the potential need for underground nuclear testing.
- *Weapons Laboratory Director Reports*: Each laboratory director submits an independent assessment report of the safety, performance, and reliability of the nuclear stockpile to the NWC and the Secretaries of Energy and Defense by December 1 of each year.
- *SAGSAT Report*: The SAGSAT prepares a report for the USSTRATCOM Commander that provides the technical underpinning for the Commander's assessment of the stockpile. This report expresses the SAGSAT's confidence as to whether each warhead type will perform as designed and makes recommendations for USSTRATCOM action.
- *Commander of USSTRATCOM Report*: The Commander of USSTRATCOM submits an independent assessment report of the safety, performance, reliability and military effectiveness of the nuclear stockpile to the NWC and the Secretaries of Energy and Defense by December 1 of each year.
- *POG Reports*: Each POG issues a technical annual assessment report to the NWC on the warhead type for which it is responsible. These reports are based largely on the weapons laboratories' AARs but also include additional information on military-service specific issues, including the results of surveillance testing performed by DOD and its contractors, operational issues such as deployment

numbers, and logistical issues such as the status of work on weapons being done at military installations.

- *Report on Stockpile Assessments:* The NWC prepares a report package, known as the “Report on Stockpile Assessments,” on behalf of the Secretaries of Energy and Defense. The package includes an executive summary, a joint letter signed by both Secretaries, and unaltered copies of the weapons laboratory director reports and the Commander of USSTRATCOM report. This package is conveyed to the President by March 1 and forwarded to the Congress by March 15 of each year.

Each annual assessment cycle takes approximately 14 months to complete. Figure 1 illustrates the time frames during which each type of annual assessment report was developed and completed during the 2005 cycle. Specifically, technical analysis conducted by the laboratories began in December 2004 and was completed in July 2005. Subsequently, the laboratory directors and Commander of USSTRATCOM completed their high-level reports by the middle of October, in advance of their December 1 statutory deadline. The NWC prepared the executive summary between the end of September 2005 and the end of February 2006.

**Figure 1: 2005 Annual Assessment Reporting Time Line**



Note: The red team reports are not listed separately but are used by the laboratory directors in completing their reports.

### The Weapons Laboratories' and Laboratory Directors' Reports Are Based on Ongoing Stockpile Stewardship Program Activities

According to laboratory officials, the information provided in the AARs—the technical basis for the annual assessment process—is derived from ongoing activities associated with NNSA's Stockpile Stewardship Program. Specifically, the AARs focus on the following three areas:

- Surveillance:** A key component of the Stockpile Stewardship Program is annual surveillance testing, in which active stockpile weapons are randomly selected, disassembled, inspected, and tested—either in laboratory tests or in flight tests—to identify any problems that might affect a weapon's safety or reliability. Problems identified during surveillance testing that may warrant further testing and analysis result in the creation of a "significant finding investigation" to determine the problems' cause, extent, and effect on the performance, safety, and reliability of the stockpile. As part of the Stockpile Stewardship Program, NNSA tracks surveillance results through quarterly reports on significant finding investigations and other surveillance reports. Each AAR (1) summarizes the

status of surveillance testing at the three laboratories; (2) details any backlog there might be in surveillance testing; and (3) describes the effect of surveillance results, significant finding investigations, or surveillance backlogs on weapon performance, safety, or reliability. In recent years, AARs have called attention to the importance of surveillance testing as weapons in the stockpile are aging beyond their original design lives. Further, AARs have highlighted limitations at the production complex, particularly at the Pantex Plant, that have contributed to surveillance backlogs.<sup>8</sup>

- *Performance:* The annual assessment seeks to determine whether each warhead type still meets the same standards it did when it was originally certified. A key standard is whether the performance of the nuclear explosive package would meet requirements for generating militarily significant yield should the weapon be used. To support this determination, LANL and LLNL use a “quantification of margins and uncertainties” (QMU) methodology, which focuses on creating a common “watch list” of factors that are the most critical to the operation and performance of a nuclear weapon.<sup>9</sup> QMU seeks to quantify (1) how close each critical factor is to the point at which it would fail to perform as designed and (2) the uncertainty that exists in calculating the margin, in order to ensure that the margin is sufficiently larger than the uncertainty. The laboratories’ use of QMU depends significantly on their ability to simulate the explosion of a nuclear weapon. Toward this end, the weapons laboratories rely on NNSA’s Advanced Simulation and Computing program, which supports stockpile stewardship by providing computer simulation capabilities to predict weapons’ performance, safety, and reliability. Computer models are validated against the historic data collected during previous underground nuclear tests and are constantly improved and updated as new data becomes available from surveillance testing, material properties testing, and other physics experiments. Based on the use of QMU, computer simulations, and experimental data, AARs report a warhead’s expected yield, factors influencing the expected yield, and the extent to which there is uncertainty in the expected yield.
- *Reliability:* All nuclear weapons are originally certified to meet a key military characteristic known as weapon reliability. DOE defines weapon reliability as “the probability of achieving the specified yield, at the target, across the Stockpile-to-Target Sequence of environments, throughout the weapon’s lifetime, assuming proper inputs.” According to laboratory officials, LANL and LLNL use QMU to support the reliability assessment of each weapon type’s nuclear explosive package, while SNL uses statistical data and QMU-based methodologies to predict the reliability of nonnuclear components. SNL then combines these probabilities to come up with an overall reliability calculation for each warhead or bomb type. NNSA issues a separate, semiannual report on weapon reliability and provides it

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<sup>8</sup>For information on the status of surveillance backlogs, see DOE Office of Inspector General, *Follow-up Audit on Stockpile Surveillance Testing*, October 2006, DOE/IG-0744.

<sup>9</sup>For more information on QMU, see GAO, *Nuclear Weapons: NNSA Needs to Refine and More Effectively Manage Its New Approach for Assessing and Certifying Nuclear Weapons*, [GAO-06-261](#) (Washington, D.C.: Feb. 3, 2006).

to USSTRATCOM for use in war planning. The laboratories' AARs republish the most recent reliability calculations in the context of annual assessment.<sup>10</sup>

To oversee the development of the AARs and to facilitate key annual assessment deliverables, each laboratory relies on an annual assessment coordinator and key technical staff. Laboratory coordinators develop schedules for the circulation of between three and five drafts of each AAR. Laboratory program managers for each weapon type are responsible for the technical content of each AAR, and dozens of other scientific and engineering staff at each laboratory participate in the development and review of AARs. Drafts of the AARs are reviewed by officials from the other weapons laboratories, the relevant POGs, and NNSA. In addition, one laboratory coordinator told us that he looks at cross-cutting issues in the AARs to ensure that they are being consistently and completely addressed. Beginning in the 2006 annual assessment cycle, laboratory coordinators from LANL and LLNL collaborated to organize an additional level of peer review by bringing both laboratory directors together to receive technical annual assessment briefings from their staffs upon completion of the AARs.

NNSA oversees the weapons laboratories' annual assessment reporting activities through the use of an annual assessment coordinator. The NNSA annual assessment coordinator said that officials throughout NNSA review drafts of the laboratories' AARs and provide comments to the laboratories on the accuracy of these reports. In addition, NNSA has issued formal business and operating guidance<sup>11</sup> for the conduct and oversight of the annual assessment process that contains milestones for key laboratory deliverables and requirements for the format and organization of laboratory AARs. At the beginning of each annual assessment cycle, the NNSA annual assessment coordinator meets with the laboratory coordinators to agree on the major milestones and key deliverables for the year and to highlight areas for improvement from the previous year. NNSA also issues formal tasking letters and an execution plan to each of the laboratories for the annual assessment cycle. The letters state that AARs should not become advocacy platforms for specific upgrades or enhancements, or for specific facilities or technology developments. In addition, the plan states that, aside from meeting statutory requirements, the format and organization of the laboratory directors' reports are left entirely up to each director.

Red teams, comprised of experts from all three of the weapons laboratories, also develop reports and provide additional technical input for each laboratory director's consideration. The use of red teams is mandated by section 3141, which requires the red teams to challenge the technical information provided in the laboratories' AARs and to provide independent analysis to each laboratory director. According to laboratory officials, red team members' activities are not constrained. For example, they can interview laboratory employees without notifying laboratory management in advance. In addition, some red team members are retired laboratory employees, which is seen as enhancing their independence. However, laboratory officials said that red teams do not have separate budgets and do not have resources to perform

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<sup>10</sup>In commenting on our draft report, NNSA officials stated that the laboratory AARs also focus on safety. Specifically, NNSA stated that the annual assessment seeks to determine whether each warhead type still meets the same safety requirements as it did when originally certified.

<sup>11</sup>NNSA Policy Letter: BOP-10.001 dated July 14, 2005 and annual tasking letters.

their own experiments or gather their own data. Instead, they are expected to pose questions to those responsible for the technical information in the AARs and make recommendations to the laboratory director. A LANL official said that the findings of LANL's red team are shared with its laboratory director and senior laboratory weapons managers. However, at LLNL and SNL, the red teams' findings are shared more broadly with laboratory staff.

Finally, the laboratory directors rely on the AARs, the red teams' findings, and additional technical assessments provided by laboratory experts and managers to write their own report, which reflects their individual assessment of the safety, performance, and reliability of the weapons in the nuclear stockpile. In particular, laboratory directors consult with laboratory technical staff to assess nuclear test readiness, the adequacy of the tools and methods employed by the production complex, and the adequacy of science-based tools and methods. Details of each of these areas of assessment are as follows:

- *Test readiness:* According to laboratory officials, each laboratory has technical staff with specific responsibilities related to the Test Readiness program, which is managed by NNSA and focuses on the ability of the Nevada Test Site to conduct an underground nuclear test, should a decision be made to resume underground testing. Laboratory staff work on an ongoing basis with their counterparts at the Nevada Test Site and, for annual assessment, brief the laboratories on the status of issues related to test readiness. In addition, laboratory directors identify high-priority nuclear tests—tests that would provide significant data to resolve identified issues—in their annual assessment reports, and this information is provided to NNSA and Nevada Test Site officials for their use in the Test Readiness program. In a separate, biannual report to the Congress, NNSA also provides data on essential workforce skills, capabilities, and infrastructure requirements to support test readiness.<sup>12</sup>
- *Adequacy of tools and methods employed by the production complex:* Laboratory officials said that laboratory employees work on-site at the production plants and provide regular updates to the laboratory directors on the status of the production complex. These officials noted that laboratory directors are not obligated to assess the overall adequacy or capability of the manufacturing complex; rather, the laboratory directors focus on the extent to which manufacturing tools and methods are sufficient to allow them to assess the safety, performance, and reliability of the stockpile. NNSA officials said that limitations at the production complex, particularly at the Pantex Plant, have contributed to surveillance backlogs, which affect the laboratories' ability to make a complete assessment. However, because the existing weapon types have been in the stockpile for decades, laboratory officials expressed confidence in their understanding of production processes and the extent to which production capabilities or inadequacies affect their ability to assess the stockpile.
- *Adequacy of science-based tools and methods:* Laboratory officials said that to assess the adequacy of science-based tools and methods, laboratory directors

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<sup>12</sup>H.R. Rep. No. 106-945 §3192, accompanying the fiscal year 2001 National Defense Authorization Act, Pub. L. No. 106-398.

consider whether the laboratories have the capabilities to continue to effectively and efficiently assess the safety, performance, and reliability of the stockpile. For example, LANL officials said that impediments to addressing significant finding investigations may call attention to areas where the laboratories' science-based tools and methods need improvement. In addition, LLNL officials said that they rely heavily on the QMU methodology to assess the adequacy of their computer modeling efforts. However, laboratory officials said that meeting the standard for adequacy does not require laboratories to have capabilities to address every question about the stockpile that may arise. Other laboratory officials acknowledged that the laboratory directors' conclusions about the adequacy of science-based tools and methods do not always agree and that, while tools and methods may currently be adequate, this assessment could change in the future.

#### The Commander of USSTRATCOM's Report Is Based Primarily on the Advice of a Technical Advisory Group

According to USSTRATCOM and SAGSAT officials, the SAGSAT fulfills its primary mission—to provide technical expertise to the USSTRATCOM Commander—by conducting an assessment of all nuclear weapons in the stockpile and reporting on this assessment to the Commander. The SAGSAT holds an annual conference to gather information from all of the parties involved in annual assessment, including the weapons laboratories, the POGs, NNSA, and DOD. The conference is typically held each year in June and lasts approximately 1 week. In advance of the conference, the SAGSAT issues guidance to each of the conference attendees describing specific topics of interest on which the SAGSAT and Commander would like to be briefed. The guidance that SAGSAT issued for the 2006 annual assessment cycle directed the weapons laboratories and the POGs to provide warhead system-specific briefings that focused on safety and security, nuclear explosive package performance, operational testing plans and results, and the projected health of the warhead. In addition, this guidance directed

- NNSA to address the overall status of the production complex and plans for addressing shortfalls in current stockpile support activities, such as surveillance testing;
- LANL and LLNL to provide information on their efforts to advance the QMU methodology and on the status of a study on the lifetime of plutonium;
- SNL to present its approach to using the QMU methodology; and
- Air Force and Navy to present an overview of the operational readiness and reliability of delivery systems to the extent that delivery system performance may have a direct effect on the performance of a nuclear warhead; a SAGSAT official told us that the SAGSAT has requested this briefing from the military services each year since 2004.

After its conference, the SAGSAT prepares its own report for the Commander that covers all of the warhead types. The report (1) makes qualitative statements about the SAGSAT's confidence in each warhead or bomb's safety, reliability, and performance; (2) provides the SAGSAT's opinion as to whether a return to underground testing is warranted for each warhead/bomb type; (3) calls attention to areas of disagreement with the laboratories or NNSA; (4) focuses on areas that could



affect operational decisions; and (5) makes recommendations for USSTRATCOM action. The SAGSAT report is forwarded to the DOD and DOE, and SAGSAT members also provide this information in an annual briefing to the NWC's Standing and Safety Committee—a working-level group that meets monthly to develop, coordinate, and approve most actions before they are reviewed and approved by the full NWC.

According to USSTRATCOM officials, the Commander of USSTRATCOM bases his assessment report largely on the advice of the SAGSAT. However, the Commander also relies on other operational information he receives from USSTRATCOM staff and the military services. For example, one group within USSTRATCOM determines the number of nuclear weapons the command needs each year, which affects decisions made about each weapon type. In addition, USSTRATCOM staff serve as voting members of the POGs. In this capacity, USSTRATCOM staff participate in and inform the Commander about operations and logistics decisions. Finally, USSTRATCOM sets requirements for flight testing, an important part of surveillance testing in which mock weapons are flown in realistic environments. The results of flight tests are reflected in the Commander's report and affect his ability to express confidence in the military effectiveness of weapon types in the absence of underground nuclear testing.

As the operator of nuclear weapons, USSTRATCOM uses information on overall weapon system reliability, which is calculated by the military services, in war planning. To this end, the USSTRATCOM Commander's annual assessment is distinct from the laboratory directors' assessments in that the Commander provides an operational perspective in his report. The Commander's report makes observations about the immediate and longer-term needs for underground nuclear testing and states whether his confidence in the reliability of each warhead type has increased, decreased, or remained unchanged. He also discusses the extent to which he believes the laboratories and military services are addressing known issues in the stockpile, calls attention to issues that could be addressed if additional programs were authorized or funded, and discusses operational alternatives to address any identified problems.

#### The POGs Produce Assessments for the NWC Based on Their Review of Ongoing DOD and DOE Nuclear Weapon Activities

Each POG develops its own annual assessment report for the NWC, reflecting the combined technical input of the POG members, including officials from NNSA, the weapons laboratories, and the military services. The information contained in the POG reports is derived from ongoing DOD and DOE nuclear weapon activities that the POGs regularly monitor. POGs conduct their work through subgroups, whose members have technical expertise in the areas germane to the subgroup's responsibility. For example, members of POG subgroups on safety and reliability are responsible for ensuring that their warheads meet all joint DOD/DOE safety and reliability requirements, including military characteristics and stockpile-to-target sequences. In addition, the LPOs of each POG are required to provide an annual briefing to the NWC's Standing and Safety Committee on the status of each weapon type, including any issues identified within the context of the annual assessment. All

reports and briefings issued by the POGs are reviewed and approved by the applicable military service before being submitted to the NWC.<sup>13</sup>

The NWC Synthesizes and Summarizes the Other Reports to Produce the “Report on Stockpile Assessments”

The NWC uses the POG reports, the weapons laboratories’ AARs, the laboratory directors’ reports, and the USSTRATCOM Commander’s report to produce the “Report on Stockpile Assessments” for the President and the Congress on behalf of the Secretaries of Energy and Defense. The “Report on Stockpile Assessments” is a package of reports, including the unaltered reports from the laboratory directors and the Commander of USSTRATCOM, NWC’s executive summary, and a joint letter from the Secretaries of Energy and Defense, which provides the overall assessment of the stockpile and states whether any official has concluded that there is a technical requirement to perform an underground nuclear test. The executive summary and joint letter are reviewed and agreed upon at three levels of the NWC over the course of several months: (1) the Action Officer level, which includes military officers at the Air Force Colonel or Navy Captain level and their civilian equivalents, (2) the Standing and Safety Committee, and (3) the full NWC. In these successive reviews, information is brought up to a higher level, and policy concerns are addressed. NNSA and laboratory officials told us the Secretary of Energy receives an extensive briefing from senior NNSA officials and the three weapons laboratory directors before signing the joint letter. USSTRATCOM officials told us the Secretary of Defense does not receive a formal briefing but rather relies upon staff in the Office of the Secretary of Defense to inform him of any issues before he signs the joint letter.

NNSA and laboratory officials have questioned whether the NWC’s executive summary provides additional value to the annual assessment process, particularly because it takes over 5 months to complete. For example, NNSA officials said that they brief the Secretary of Energy on annual assessment several months before the NWC’s executive summary is complete. Further, a laboratory official said the executive summary focuses too much on restating technical information rather than providing the context in which the technical information should be received. However, congressional staff and a former National Security Council official with whom we spoke—end users of the annual assessment reports—told us they found the executive summary useful for identifying issues and comparing high-level conclusions from year to year. For example, the 2005 NWC executive summary (submitted in March 2006) highlighted differences in opinion between (1) the LANL and LLNL directors as to the adequacy of science-based tools and methods and (2) the laboratory directors and the Commander of USSTRATCOM on long-term needs for nuclear testing. Furthermore, NWC and congressional staff said that a lot of time is spent coordinating between the Offices of the Secretary of Energy and the Secretary of Defense to get their signatures on the “Report on Stockpile Assessments” package. As a result, according to these officials, the NWC would still

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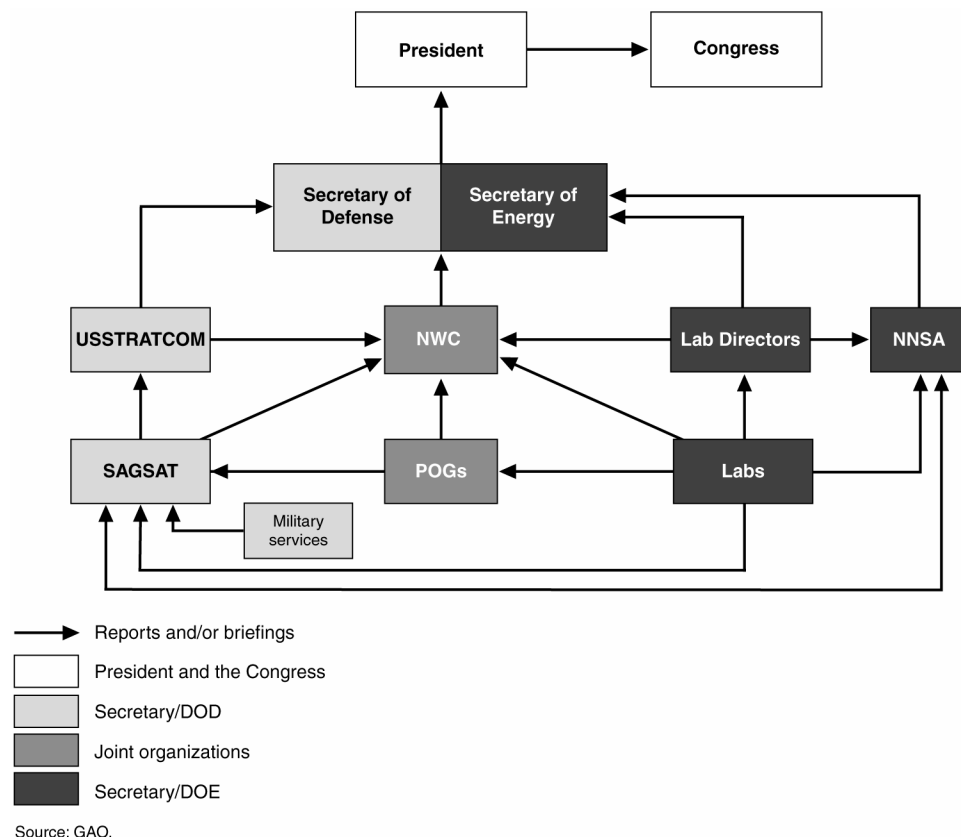
<sup>13</sup>In the Navy, the chief officer of the Strategic Systems Programs Office reviews Navy-led POG reports and briefings. In the Air Force, the chief officers of the Nuclear Weapons Counterproliferation Agency and its parent organization, the Strategic Security Directorate, review Air Force-led POG reports and briefings.

take a considerable amount of time to complete its activities even if it did not write an executive summary.

### The Annual Assessment Provides a Forum through Which the Nuclear Weapons Community Collaborates on Technical Issues

While individual members of the nuclear weapons community are responsible for developing their own reports as part of the annual assessment, the annual assessment process has broad participation from organizations that are responsible for the stockpile and provides a forum through which the nuclear weapons community collaborates on technical issues affecting the safety, reliability, and performance of the stockpile. For example, officials from DOD and DOE stated that the SAGSAT provides a unique function within the annual assessment process. Its annual conference is the only occasion that brings together all of the organizations involved in annual assessment—including the weapons laboratories, the POGs, NNSA, DOD, and the military services—at one time to discuss each weapon at a technical level. One DOD official said the collaborative aspect of the annual assessment process is unique and is a benefit completely separate from the reports or other written products. Collaboration during the annual assessment process can also lead to the resolution of disagreements. For example, after concerns over DOD support for weapons flight tests were raised, the NWC tasked NNSA and USSTRATCOM to determine whether the agencies could support changes to flight test requirements. Figure 2 illustrates the collaborative aspect of annual assessment process.

**Figure 2: Interagency Collaboration During Annual Assessment**



## The Annual Assessment Process Is Not a Vehicle for Reporting Immediate Issues Regarding Nuclear Testing

While the principal purpose of annual assessment is to provide an analysis of the safety, reliability, performance, and military effectiveness of the nuclear stockpile, the process would not be used as a vehicle for notifying decision makers about an immediate need to conduct a nuclear test. As stated earlier, the annual assessment process takes 14 months to complete. According to DOE and DOD officials, if an issue with a weapon were to arise that required an underground nuclear test to resolve, the Secretaries of Energy and Defense and the President would be notified immediately and outside of the context of the annual assessment process. DOD and NNSA officials told us that the annual assessment reports are intended to provide information on the safety and performance of the stockpile within a particular time frame and are not a good tool for reporting on problems that need to be addressed immediately. A senior congressional official agreed with this characterization and said that if an immediate issue arose for which nuclear testing was considered necessary to resolve, it would be appropriate to notify executive and congressional decision makers directly.

Finally, according to laboratory officials, there are several options the nuclear weapons community could explore before conducting an underground nuclear test. These options include component replacements, refurbishments, selective retirements, and approving exceptions to military characteristic or stockpile-to-target sequence requirements. Laboratory and congressional officials said all of these options would be rigorously considered before recommending an underground nuclear test. However, a DOD official also said that if an issue were to surface suddenly that required an underground nuclear test, the length of time it would take to prepare for an underground test—which could be 18 months or more—would probably exceed the length of each annual assessment cycle. As a result, the annual assessment reports would ultimately reflect a decision to resume underground nuclear testing.

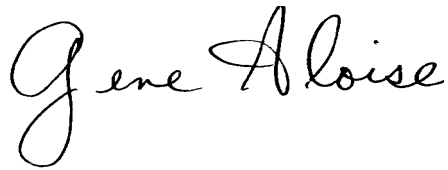
### **Agency Comments and Our Evaluation**

We provided a draft of this report to NNSA and DOD for their review and comment. Overall, NNSA stated that it generally agreed with the findings of the draft report. The complete text of NNSA's comments on our draft report is presented in enclosure I. NNSA also provided technical comments, which we incorporated into the report as appropriate. DOD provided oral comments of a technical nature, which we incorporated into the report as appropriate.

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As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies of this report to the Secretaries of Energy and Defense, the Administrator of NNSA, and appropriate congressional committees. We also will make copies available to others upon request. In addition, this report will be available at no charge on the GAO Web site at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-3841 or aloisee@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributions to this report were made by James Noel, Assistant Director; Allison Bawden; Jason Holliday; John Delicath; and Doreen Feldman.

A handwritten signature in black ink that reads "Gene Aloise". The signature is written in a cursive style with a large, stylized "G" and "A".

Gene Aloise  
Director, Natural Resources  
and Environment

Enclosure

## Comments from the National Nuclear Security Administration



Department of Energy  
National Nuclear Security Administration  
Washington, DC 20585



January 24, 2007

Mr. Gene Aloise  
Director  
Natural Resources and Environment  
Government Accountability Office  
Washington, DC

Dear Mr. Aloise:

The National Nuclear Security Administration (NNSA) appreciates the opportunity to review the Government Accountability Office's (GAO) draft report, GAO-07-243R, "NUCLEAR WEAPONS: Annual Assessment of the Safety, Performance, and Reliability of the Nation's Stockpile." We understand that this audit was performed at the request of the House's Subcommittee on Strategic Forces, Committee on Armed Services to determine how our laboratories fulfill the requirements of the annual assessment, how we coordinate their efforts and how the laboratories apply science-based tools to the effort.

NNSA generally agrees with the report and appreciates the efforts of the GAO in this endeavor. For the sake of clarity and correctness, I have attached an annotated copy of the draft report which incorporates NNSA's comments.

Should you have any questions, please contact Richard Speidel, Director, Policy and Internal Controls Management.

Sincerely,

Michael C. Kane  
Associate Administrator  
for Management and Administration

Attachment

cc: Deputy Administrator for Defense Programs  
Senior Procurement Executive  
Director, Service Center



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